CLAIMS

1. An apparatus comprising:

a thinned active semiconductor substrate;

a support substrate for supporting the thinned active semiconductor substrate; and

a magnetically permeable glue disposed between the active semiconductor substrate and the support substrate.

2. The apparatus of claim 1 wherein the support substrate is magnetically permeable.

3. The apparatus of claim 2 wherein the support substrate and the glue each comprise a magnetically permeable substance, the magnetically permeable substance comprising at least one of the group consisting of cobalt; nickel and iron.

4. The apparatus of claim 3 wherein the support substrate comprises:

a first layer having a coefficient of thermal expansion substantially equal to the integrated circuit, the first layer being in contact with the glue; and

a second layer coupled to the first layer, the second layer comprising the magnetically permeable substance.

5. The apparatus of claim 3 wherein the active semiconductor substrate comprises a magnetoresistive random access memory.

6. The apparatus of claim 1 wherein the glue comprises:

a bonding agent; and

a magnetic permeability enhancing agent.

7. The apparatus of claim 6 wherein the bonding agent comprises one of the group consisting of benzocyclobutene (BCB) and an epoxy.

8. The apparatus of claim 6 wherein the magnetically permeable enhancing agent comprises at least one of the group consisting of cobalt, nickel and iron.

9. The apparatus of claim 6 wherein the magnetic permeability enhancing agent comprises a plurality of magnetically-permeable, colloidal-sized particles suspended in the bonding agent.

10. The apparatus of claim 9 wherein the glue has a first thickness and the particles have an average maximum dimension not substantially greater than half the first thickness.

11. The apparatus of claim 9 wherein the active semiconductor substrate has a thickness of less than 200 microns.

12. An apparatus comprising:

a thinned integrated circuit wafer;

a support wafer having a first characteristic, the first characteristic being at least one of the group consisting of thermally conductive, electrically conductive and magnetically permeable; and

a glue having the first characteristic, the glue being disposed between the integrated circuit wafer and the support wafer.

13. The apparatus of claim 12 wherein the integrated circuit wafer comprises a plurality of the integrated circuits.

14. The apparatus of claim 13 wherein the apparatus comprises a three-dimensional wafer-to-wafer bonded structure including the integrated circuits, the substrate and the glue.

15. The apparatus of claim 12 wherein the glue comprises:

a bonding agent; and

a first characteristic enhancing agent.

16. The apparatus of claim 15 wherein the bonding agent comprises one of the group consisting of benzocyclobutene (BCB) and an epoxy.

17. The apparatus of claim 15 wherein

the first characteristic enhancing agent comprises a plurality of colloidal-sized particles suspended in the bonding agent, the colloidal particles being monolithic and coated nanosilica spheres.

18. The apparatus of claim 12 wherein the glue has a first thickness and the particles have an average maximum dimension not substantially greater than half the first thickness.

19. The apparatus of claim 12 wherein the first characteristic is magnetically permeable, and the substrate and the glue each comprise a magnetically permeable substance, the magnetically permeable substance comprising at least one of the group consisting of cobalt; nickel and iron.

20. The apparatus of claim 19 wherein the substrate comprises:

a first layer having a coefficient of thermal expansion substantially equal to the integrated circuit, the first layer having the first surface; and

a second layer comprising the magnetically permeable substance.

21. The apparatus of claim 19 wherein the integrated circuit is a magnetic memory.

22. The apparatus of claim 12 wherein the substrate comprises one of the group consisting of silicon carbide and heavily doped silicon.

23. The apparatus of claim 12 wherein the first characteristic is electrically conductive, and the substrate and the glue each comprise at least one of the group consisting of a metal and carbon.

24. The apparatus of claim 12 wherein the first characteristic is thermally conductive, and the substrate and the glue each comprise at least one of the group consisting of a metal, a metal oxide, and cobalt.

25. A method of making a semiconductor device comprising:

providing an integrated circuit bearing structure with a first surface;

selecting a substrate structure material having a first characteristic, the first characteristic being at least one of the group consisting of thermally conductive, electrically conductive and magnetically permeable;

providing a substrate structure comprised of the selected substrate structure material, the substrate structure having a second surface;

providing a glue having the first characteristic; and

gluing the integrated circuit bearing structure to the substrate structure using the glue.

26. The method of claim 25 wherein the step of providing the glue comprises:

providing a bonding agent; and

providing an amount of first characteristic enhancing agent; and

mixing the bonding agent and the first characteristic enhancing agent.

27. The method of claim 26 wherein the bonding agent is provided in liquid form and the first characteristic enhancing agent is provided in particulate form, and wherein the bonding agent and the first characteristic enhancing agent are mixed to provide a colloidal glue such that particles of the first characteristic enhancing agent are dispersed within a substantially continuous medium of the bonding agent.

28. The method of claim 25 wherein the step of gluing the integrated circuit bearing structure to the substrate structure comprises:

depositing the glue on at least one of the first and second surfaces;

placing the first and second surfaces in proximity with each other such that the glue extends between the first and second surfaces; and

curing the glue to bond the integrated circuit bearing structure to the substrate structure.

29. The method of claim 25 wherein the integrated circuit bearing structure is a wafer, the method comprising:

singulating a plurality of integrated circuits from the wafer, each of the integrated circuits comprising a portion of the wafer, the substrate and the glue.

30. The method of claim 25 further comprising:

selecting the substrate structure material to have a second characteristic, the second characteristic being another one of the group consisting of thermally conductive, electrically conductive and magnetically permeable.

31. The method of claim 25 wherein the integrated circuit bearing structure is a first integrated circuit bearing structure, the method further comprising:

providing a second integrated circuit bearing structure;

connecting the second integrated circuit bearing structure to the first integrated circuit bearing structure.

32. A method of making a colloidal glue comprising:
selecting a characteristic from the group of thermally conductive, electrically conductive, and magnetically permeable;
providing a glue having the selected characteristic; and
bonding an integrated circuit layer to a substrate layer using the glue having the selected characteristic.

33. The method of claim 32 further comprising:
thinning the integrated circuit layer after bonding.

34. The method of claim 32 further comprising:
providing the substrate layer with the selected characteristic.

35. The method of claim 32 wherein the providing the glue comprises:
providing a base adhesive agent; and
adding a characteristic agent to the base adhesive to provide a glue having the selected characteristic in colloidal suspension.